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Defense Industrial Base Strategy for the 1990's

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ABSTRACT

Examines the critical role of the defense industrial base in the implementation of the National Security Strategy. Defines the desired characteristics of the defense industrial base, as well as recent trends and actions to improve the responsiveness of the base. Concludes that an industrial base strategy is required to ensure a defense industrial base that supports Reconstitution.

Defense Industrial Base Strategy for the 1990's
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DISCLAIMER

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DEFENSE INDUSTRIAL BASE STRATEGY FOR THE 1990's

INTRODUCTION

The public debate on the nature and status of the defense industrial base has proceeded for as long as many people can remember. In fact, the debate has been so ardent and so protracted that one observer has suggested a new cottage industry of analysts has arisen to satisfy the demands of the political system and special interest groups involved (Blackwell, 189).

In following the debate, it soon becomes clear that the number of positions on the issues is limited only by the number of participants. One end of the spectrum seems to represented by special interest groups who shroud arguments for protectionism in the more socially acceptable cloak of national security. The opposite pole of the debate is represented by those legitimately concerned about the military and economic future of our nation. Regardless of the hidden motives, the status and projected future of our defense industrial base is an issue on which knowledgeable people clearly disagree.

This paper is structured to:

1) Highlight the role of the defense industrial base in our National Security Strategy

2) Present the desired characteristics of the defense industrial base

3) Analyze emerging trends

4) Forward recommended actions to strengthen the defense industrial base

5) Provide the rationale for the establishment of an industrial base strategy.

BACKGROUND

While the interest in defense industrial base preservation has been prevalent since the early days of our nation, the health of the base has taken on new importance in the last few years. During the Cold War, our National Security Strategy was based on the principle of deterrence through the threat of assured mutual destruction. In order to implement this strategy, it was necessary for this nation to develop and maintain an arsenal of strategic weapons, retain a large standing Armed Force, and be prepared to implement a strategic response in a matter of minutes. Military conflict was viewed as a "Come-As-You-Are War," where the time constants of the situation would force us to fight with the combat capability we possessed at crisis initiation.

With the demise of the Soviet Union, the nature of the threat facing our nation changed overnight. In turn, our National Security Strategy was modified to reflect the new international environment in which we found ourselves. We will still pursue ***Strategic Deterrence***, and to some degree ***Forward Presence***, but we will significantly reduce the size of our

standing Armed Force. While maintaining sufficient military force to allow ***Crisis Response***, we will rely on ***Reconstitution*** to regenerate a larger, more capable military force, should the threat to our national security increase significantly (National Security Strategy, 14-15).

While past experience permits us to feel fairly comfortable with the other legs of our strategic table, the concept of Reconstitution, as a principal element of National Security is relatively new. Reconstitution applies not only to the recreation of a global military end strength, but also to the activation of the defense industrial base to equip and re-supply our forces. Reconstitution assumes our ability to Mobilize...something this nation has not attempted in well over two generations. Because of this, many observers, as well as the Chairman of the Joint Chiefs of Staff, believe that "In the final analysis reconstitution may well prove to be the linchpin of America's long term security" (Joint Chiefs of Staff).

Despite the projections of many critics, the weapons developed since the Vietnam Era performed brilliantly during the Persian Gulf War. The cheers for the military-industrial complex had yet to clear the halls of Congress before budget reductions were imposed on some of the very systems that made this victory possible. "Even as the nation watched the Gulf War on television, many of the firms that produced the impressive weapons were releasing workers, closing plants, and searching for

non-defense business. In many ways, the war reflected an industrial base that no longer exists" (Correll, 7)

The new importance of the long standing debate over the status of the industrial base is derived from the critical role of the defense industrial base to our National Security Strategy. Reconstitution may prove to be a weakness in the strategy, as it depends to a large extent on a defense industrial base that may not be there when the time comes.

A COMMON BASELINE

Before delving into the many issues surrounding the defense industrial base, it would be advantageous to establish a common understanding of what the defense industrial base, is and to define its desirable characteristics.

There is no universally excepted definition of the defense industrial base. Definitions are bounded at one end by a school of thought that insists that in actuality there is no defense industrial base.....rather the Nation has a single industrial base and those responding to the defense needs of the country comprise a small sector of the larger, more comprehensive base.

For the purpose of this paper, I have chosen to adopt the definition used by the Office of Technology Assessment in what they call the Defense Technology and Industrial Base (DTIB)... defined as:

> the combination of people, institutions, technological know-how, and facilities used to design, develop, manufacture, and maintain the weapons and supporting defense equipment needed to meet U.S. national security objectives. The base consists of three broad components: a research and development component, a production component, and a maintenance and repair component, each of which includes private and public-sector employees and facilities. The base can also be divided into three tiers: prime contractors, subcontractors, and parts suppliers. While the DTIB is usually thought of as an independent entity, it is in fact part of the larger civilian technology and industrial base and is increasingly international (Redesigning Defense, 3).

The very nature of this definition reflects the complexity of the industrial base and intricacy associated with modification of its characteristics. The structure of the industrial base can be view as multi-dimensional...and can be analyzed within the following frames of reference; scope of operations, industrial sectors; functions performed; and ownership classification.

The optimum environment for any single dimension of the industrial base, however, is not necessarily a healthy surrounding for any one of the other dimensional elements. For example, policies that would assist a small, privately-owned, electronics, fabrication business, probably not be beneficial for a large, government installation, specializing in research and development of ship mechanical systems.

Scope of Operations. This element divides the industrial base by the nature of the work performed. Principally this dimension is composed of prime contractors; sub-contractors; and suppliers of parts, material, and services. Conditions that effect large defense contractors are often significantly

different than those effecting sub-contractors and parts vendors.

Industrial Sectors. Industries that supply the defense needs of the nations can be divided into sectors that represent the type of products and services they supply. The most commonly used sectors are:

* Aerospace
* Shipbuilding
* Munitions
* Combat Vehicles
* Electronics

Each sector has unique requirements that allow that sector to flourish. Some industries are geared to the production of single items.....satellites and ships; while others are more focused on mass production....electronic components and munitions. Policies that benefit shipbuilding, for example, would not necessarily be beneficial to the electronics industry (Redesigning Defense, 14-15).

Functions Performed. Components of the DTIB perform different functions, all of which are essential, but at different times during the life cycle of a end item. Principal functions include:

* Research and Development
* Production
* Maintenance

Different kinds of knowledge, facilities, and equipment are

required to successfully perform the required tasks in each functional area.

Ownership Classification. This dimension refers to the that the means of production is owned by the government or by private business. The degree of public ownership varies significantly from one industry sector to another. "All shipyards (for new construction) are in the private sector; approximately one-third of the plant and equipment in the aircraft industry is government owned; in the munitions industry, almost all of the final assembly operations are in the public sector" (Gansler, 240). It is important to be aware of these differences as the responsiveness of the industries to investment, and research and development (R&D) incentives will differ greatly as ownership of the means of production differs.

ROLE OF THE DEFENSE INDUSTRIAL BASE

In order to further analyze the DTIB it is necessary to outline the contribution that it is expected to make to the overall security of the nation. Achievement of our National Security Objectives is normally sub-divided into Political, Economic and Military Agendas...all of which are supported in some manner by the DTIB.

Political. From a position of strength, we have been able to forge strong military alliance which help maintain world

peace, and manage crises. Material provided by the DTIB make it possible for us to provide a security umbrella for emerging nations, obviating the need for large miliary expenditures on their part.

Economic. As a highly visible portion of the national economy, the DTIB makes a significant contribution to the health of the national economy. Currently, a large portion of the total U.S. research and development funding is directed toward defense related needs. When DoD and DOE defense related funds are added, 60% of the federal R&D budget supported the national defense in 1992 (National Science Board, 99). In the international environment, weapons sales to foreign nations compose a major part of the nation's exports.

Military. In support of our military objectives, the DTIB has two principal functions. In peacetime, it is the instrument through which we develop, produce, and support the material items used by the military system. During times of crisis, or war, the DTIB must respond to the increased requirements for wartime material. Additionally, a healthy industrial base is regarded as a major factor in the deterrence of war.

INDUSTRIAL BASE VISION

If the defense industrial base is to satisfy its role in the national security strategy, we must :

* Establish the essential characteristics of a responsive DTIB

* Understand the current status and significant trends that influence these characteristics

* Define courses of action that will improve the current status of the base.

In the remainder of this section, I will explore the some of the desired characteristics that an "optimized" DTIB would possess.

The DTIB must satisfy two main objectives:

1) During peacetime...provide high performance weapon systems, at an affordable cost; and

2) During times of conflict...provide responsive production of weapons and support equipment to satisfy the needs of our combat forces.

To assist in framing the debate over the industry base posture, the Office of Technology Assessment (OTA) has developed a set of desired characteristics for a future DTIB. This OTA analysis has served as the basis for the remainder of this section (Redesigning Defense, 81-102).

Advanced Research and Development Capability. The Persian Gulf War clearly demonstrated the advantages of advanced technology when applied to weapon systems. The Coalition Forces were able to fight, and win, with minimal losses of personnel and equipment. Stand-off weapons and stealth technology are good examples of the force multiplication effect that can be provided through the use of advanced technology. Technology applicable to intelligence systems is especially critical as we will rely on

the intelligence products generated to identify the signs of enemy hostile action, and to initiate the reconstitution process. The DTIB must continue to provide and maintain such technological leadership.

Technology Interchange With Civilian Sector. The industrial base must make optimum use of technology developed by the civilian sector. In responding to market forces, the civilian sector has surpassed the level of technology employed in military products in many areas. The well structured DTIB makes practical use of such "free" technology. While the commercial sector will never develop all the technology necessary to satisfy the needs of the military community, there are areas that technology and products can satisfy both military and commercial requirements.

Innovative Acquisition Strategies. In order for the DTIB to be more cost-effective during peacetime, new acquisition strategies will be necessary. Through planned, incremental improvement of existing systems, new technology could be incorporated into existing systems. Continuous design and prototyping could provide for new systems designs, without taking every system to full rate production and deployment. Emphasis would be placed on:

* Advanced Technology Development
* Preserving Design Teams
* Minimizing Risk
* New Concept and Materials Development

* Critical Manufacturing Processes Maintenance
* Continuous Product Improvement
* Continuous operational assessment

Efficient Engineering and Manufacturing Capability. The future DTIB would require the capability to perform engineering and manufacturing development as well as production of new or improved weapon systems. Emphasis would be on efficient designs and production schedules rather than on unbounded system performance. Users, proponents, or sponsors of systems under development must be prepared to state performance requirements as aspiration levels; not as a rigidly stated set of mandatory characteristics.

Responsive Production Capabilities. Reserve material and stockpiles of munitions will be reduced as the Base Force is reduced in size. Even during minor conflicts, usage rates of many items reach levels that soon would deplete our stockpiles. In our recent war with Iraq for example, 25% of our stockpile of conventional land attack Tomahawk missiles was expended during the first week of combat (Kandebo, 29). The desired DTIB should be capable of rapidly producing the projected combat usage rates of critical end items. The capability of critical industries to satisfy surge production requirements must be incorporated into the initial production decision process and associated funding.

Ability to Effectively Mobilize. Any significant military conflict will require conversion of civilian production capacity

to the production of military equipment. The planning and the national commitment to prepare for mobilization is a critical element of any reconstitution strategy. It has been our history to "react to" contingencies rather than to "plan for" the courses of action needed. Without some level of planning and front end implementation, the ability to effectively mobilize will not be available when it is needed.

Maintenance and Support Infrastructure. If we are procuring new or replacement systems at a slower rate, the future DTIB must include a viable capability to repair, maintain, and upgrade fielded systems. Potential exists to more effectively integrate the facilities used for production, maintenance and overhaul.

Integrated Management. Achieving the objectives for the future DTIB in a fiscally constrained environment will require innovative management that is able to balance between the temptation to micro-manage and the neglect of the past. Creation of a responsive defense industrial bases, especially in a marketplace in which the government is the sole consumer, will not occur unless an integrated strategy is developed and implemented. While recent changes within the Department of Defense have consolidated life cycle management responsibilities for weapon systems and equipment, a fully integrated management approach has not been effected.

In a few words, the future DTIB needs to be:

* Driven by technology
* Flexible
* Integrated
* Responsive
* Well managed

This is a difficult task!

TRENDS AND ISSUES

Barely a day goes by without news of new corporate mergers, downsizing, or restructuring of one kind or other. Parallel articles and analyses discuss the relative decline in the productivity of American industry and the inability of U.S. firms to compete in the international marketplace. Such symptoms are signs of changes taking place in our industrial base. Conclusions drawn by the authors vary from the doomsday scenario to patriotic support of the American worker and the free enterprise system. The following sections provide some insight into the emerging trends that affect each desired capability for a future DTIB. While discussed separately, it should be kept in mind that these capabilities form an integrated set. Policies developed for enhancement of R&D, for example, will have an affect on the condition of the manufacturing base, as well as maintenance and rework facilities.

Advanced Research and Development Capability. There

continues to be a high degree of emphasis on maintaining a strong R&D capability within our defense industry base. In late 1991, the Department of Defense provided program guidance that provided for a goal of 2% real growth in the technology base portion of the research and development budget. (USD(A) Memorandum of 31 December 1991). This was further reinforced by another memorandum from the Under Secretary of Defense (Acquisition) dated 20 May 1992.

The Department of Defense, the Department of Commerce and the Office of Technology Assessment each have their own version of a "Critical Technology List" that, in the opinion of the originators, identifies the high payoff, or crucial areas to pursue. The office of Technology Assessment has also prepared a National Technology Policy. While it is somewhat disconcerting to know we have three different lists...it is comforting to know that the technologies identified in all three lists are closely aligned (Redesigning Defense, 74).

Another technology related effort that has been viewed as highly successful is the government/industry joint venture in semiconductor research SEMATECH. The consortium was initially launched to re-establish American leadership in the manufacture of dynamic random access memory chips. While leadership has yet to be obtained, most believe the U.S. is at least at parity with foreign competition (Lifeline Adrift, 41). Other benefits from the SEMATECH arrangement include the development of industry

standards in component manufacture as well as providing a forum to share pre-competitive research results.

Nationally we have a healthy network of federal sponsored R&D activities. These include Department of Defense (Advanced Research Projects Agency, Service Laboratories and R&D Centers), National Aeronautics and Space Administration, Department of Commerce (National Institute of Standards and Technology), Department of Energy (National Laboratories), and the Federally Funded Research and Development Centers.

Manufacturing technology (MANTECH) too, seems to be having a resurgence. For a few years, programs dedicated to technology that serves manufacturing processes was being down-played. The conventional wisdom had been for contractors who were awarded manufacturing contracts to develop the technology they required to perform each task. In the FY 1991 defense Authorization Act, Congress provided a 50% increase in the funding requested by the administration for the MANTECH program, and mandated the development of a Manufacturing Technology Plan (Redesigning Defense, 53).

While the prospect for the technology base looks rosy, other aspects of the entire research and development picture are colored less brightly. "While the current DoD budget request contains a shift in relative emphasis toward R&D.... over the long term, however, the military base will almost certainly shrink. Funding is expected to drop in real terms from around

$40 billion today, to between $25 and $27 billion (in 1992 dollars) by 2001. Moreover, DoD will have to pay explicitly for defense R&D rather than follow the past practice of funding it partially through production" (Building Future Security, 11).

One adverse effect on the funding available for defense research and development is caused by the anticipated reduction in the funding applied to production contracts in the future. Businesses with production contracts are allowed to include research and development costs, as part of their allowable overhead expenses. Reductions in weapons systems procurement, will have a marked effect on R&D funds derived from this source.

Additionally, industry incentive to expend its own resources on research and development due to the regulations and procedures followed by the government. For example, when a cost reimbursable contract is used, any technology developed by the contractor to reduce his costs results in a reduction of the dollar value of the contract, with no financial advantage received by the contractor. When dual sourcing of production contracts is used, the results of company investments made by the developing contractor is passed along to the "second source." Dispute over ownership of rights and data are not uncommon in this environment. Small business who have managed to capture a market niche based on unique processes and procedures often avoid government sponsored work for these reasons.

The overall research and development capability of this nation is extensive, but clearly declining. Such downward spirals tend to feed upon themselves.....as funding levels are reduced, firms invest less in R&D and productivity enhancements as they struggle to survive. The less they invest, the less competitive they become, until many inevitably collapse.

Many of the changes necessary to preserve the needed strength of the R&D sector will not happen by themselves. In order to preserve our national capability in this area, supportable policy and appropriate funding will be required.

Technology Interchange With Civilian Sector. In 1991, 51% of the funding applied to research and technology in this country was provided by the civilian sector (National Science Board, 92). In many cases technology developed by private industry has no application to military needs. On the other hand, there are a wide variety of areas in which the military could prosper from innovations created within the civilian sector. Electronics, telecommunications, clothing, health care, and individual equipment are examples of areas in which interchange of knowledge, processes, and products would be advantageous.

Access to information and technology is not, however, easily obtained. Government auditing procedures tend to isolate the defense industry form the rest of the economy. Because the government is the only consumer of weapons systems, the price for

materials can not be determined on the open market. To compensate for this condition, the government has established an elaborate accounting system that monitors costs and establishes appropriate profit levels. Most companies that conduct business with both the government and commercial customers, establish a "government products division" to ease the task of allocating costs to the products they sell to the government. Such separation discourages the coordination of technical concepts among employees of the same company as well as with others in the industry.

Additionally, when unique and novel technology is developed under a contract funded by the government, "rights and data" associated with the development become the property of the government. Firms are not willing to use innovative processes and techniques that they consider "proprietary" in a government contract if they could loose exclusive rights to their ownership.

The final barrier to the interchange of technology between the public and private sectors involves the nature of government specifications. In the purchase of equipment and material, the government often stipulates the precise processes to be followed in the manufacture of the product. The contractor does not have the latitude to substitute innovative concepts even if they are more advantageous to the government.

There has, however, been a recent thrust to improve the interchange of technical information between government and

industry. The Federal Technology Transfer Act of 1986 was enacted to promote the transfer of technology developed within the government to state and local governments as well as to the private sector. The Act encourages the establishment of Cooperative Research and Development Agreements (CRADA's) that define, in advance, the rights of participants to resulting products and inventions that emerge from the process. While the CRADA's have helped in the flow of technology from the government, little has been done to help the flow of innovative ideas in the opposite direction.

Innovative Acquisition Strategies. In the recent past, there have been several initiatives that have been focused on using new and innovate acquisition strategies to improve the overall effectiveness of the DTIB. Some of these policies have existed for several years and have already contributed to the health of the DTIB. They include:

* Acquisition Streamlining
* Non-Developmental Item procurement
* Commercial Off-the-Shelf procurement
* Advanced Technology Demonstrations
* Foreign Comparative Test Program

The Undersecretary of Defense (Acquisition) has initiated several new policies directed at enhancing the effectiveness of the DTIB...to include more focused efforts in the following areas:

* Defense Management Review (and implementing decisions)
* Defense Science and Technology Strategy
* Fieldable Prototype Development
* Acquisition Policy Modifications
* Dual-Use Technology
* Flexible Manufacturing

Among the more recent of these is the 20 May 1992 Under-secretary of Defense (Acquisition) memorandum on "Defense Acquisition", which revises the department's overall approach to obtaining new systems and equipment. This strategy emphasizes:

* Continued development of producible new systems
* Development of innovative manufacturing technologies
* Establishment of an industrial base oversight process
* Industrial base changes to increase efficiency and competition

The over zealous seekers of the "Peace Dividend" are often too eager to offer "innovative strategies" that help to justify massive reductions in expenditures. Some of the ideas merit attention, but the analyst must seek out what I call "Policy without Programs." That is, a policy that sounds good and makes sense on the surface, but is not backed up with programs or resources that are required to ensure its effective policy implementation.

The concept of Reconstitution could be considered one such hollow policy. It represents the optimum solution to the

maintaining an affordable national defense capability, but in a monopsony market place, the events and activities that must transpire to implement this policy will not happen on their own. As there is no open market for defense goods; there is no "invisible hand" to move the suppliers in the directions that respond to the wishes of the seller.

The overall trend has been to issue a wide variety of independent policies to impact one focused problem area. What has been lacking is an overall strategy that ties the policies together and provides enough detail to form a coherent program.

Efficient Engineering and Manufacturing Capability. This capability area along with the technology development area constitutes the research and development portion of the defense industry base. Once the technology has been effectively demonstrated, the development of a weapon system proceeds to the engineering and manufacturing stages. Most trends in this area appear to be the continuation of policies or conditions that have been in effect, to include:

* Overly demanding process specifications
* Rigorous government contracting and auditing requirements
* Declining business opportunities
* Program instability

The problems associated with "over specification" of manufacturing processes and government contract auditing

procedures have been discussed above. Both severely limit the amount of initiative a contractor is allowed to take in the development of more effective processes and materials.

Declining business opportunities is having several adverse affects on the engineering and manufacturing capability of the DTIB. With reduced defense budgets fewer companies will be able to survive the shrinking marketplace. This causes several chain reaction events to take place... all of which have an adverse affect on the health and diversity of the base.

First, when business conditions become tight, prime contractors have the tendency to retain work in-house that would ordinarily be contracted out. While this preserves the prime contractor at the expense of the sub....the work is often performed less efficiently by the prime contractor, and will eventually result in the loss of the sub-contractor from the DTIB. This loss can be incurred in two ways:

1) by the sub-contractor converting his business to support the commercial market, or

2) by the sub-contractor going out of business completely.

Additionally, in times of declining markets, firms tend to spend a larger portion of their resources in paying day to day expenses in lieu of increasing capital investment. If the firm survives the period of market depression, it will be in a much weaker position.

The final continuing trend in this capability category is the incessant Congressional involvement in the details of acquisition programs. The appropriations within the defense department contain a majority of the discretionary funds of the entire federal budget. With their budgetary hands tied in other areas, the members of Congress are able to influence many portions of the defense budget without effecting existing legislation. The end result is a lack of stability in individual program budgets that imparts an unnecessarily high degree of risk into already approved acquisition programs.

While the efficiency of the engineering and manufacturing capabilities of the DTIB remain relatively unchanged, it is a area in which we must make drastic improvements in order to stay competitive...not only within the defense sector, but as a nation.

Responsive Production Capabilities. One of the most obvious, desired characteristics of the DTIB is its ability to produce both the type and quantity of goods needed by the armed forces in times of conflict. In the past, the production sector of the DTIB has generally been "blessed" with excess production capacity. In short, there was a surplus of facilities, machinery, and trained manpower to respond to production surge requirements. This situation, however, is rapidly changing.

As defense budgets are reduced, many firms are selling off excess production capacity to obtain capital needed to weather

the economic climate. Workers who become unemployed in the shrinking defense industry have sought employment in the more stable commercial sector.

In the shrinking defense market, firms do not re-invested in capital equipment that could potentially increase productivity. This activates a descending spiral of relatively higher productions costs, reduced competitiveness, reduced market share, and reduced profits. Some firms will be faced with the decision to convert from defense business or go out of business. Both prime contractors and suppliers are affected. The overall effect is a weakened and/or smaller pool of suppliers to respond to surge requirements.

Another result of this "restructuring" of the defense supplier base has been in the recent trend of foreign companies acquiring U.S. firms that were active suppliers to the defense needs of our nation. In the event of most regional conflicts, global transportation nets remain accessible---so it would be possible to obtain material from foreign owned sources. Less reliable, however, are the political bonds that tie the countries involved. While no critical problems arose in the Persian Gulf War, the U.S. Government was required to intervene on multiple occasions to obtain need spares and equipment from foreign sources (Blackwell, 197).

With the increasing globalization of the economy and related commercial interdependence, the industries that support the

national defense are also moving in the direction of such interdependence. The nation must find a balance between the economic advantages of such practice, and the risks to our overall readiness in times of conflict.

Ability to Effectively Mobilize. The same factors that influence our ability to maintain a responsive production capability also effect our ability to mobilize. With a smaller DTIB, more efficient use of our production assets and international dependence, our ability to unilaterally mobilize has severely declined.

Another factor that contributes to this decline, is the divergence of the technology used to produce commercial products and related military material. For example, armored vehicles produced during the World War II, employed much the similar technology as the automotive products of the day. Today's tanks employ composite materials, turbine engines, reactive armor, and complex electronics in weapons control systems that are not employed in commercial products.

America has not been required to convert the means of production from commercial good to military goods in several generations. It is not a capability that is ever "practiced" by industry and one we are not prepared to perform in times of national emergency.

Maintenance and Support Infrastructure. Complex weapons

systems require technologically advanced facilities and knowledgeable personnel for repair and maintenance. DoD analyses have indicated that we currently have excess capacity in the area of maintenance infrastructure (Building Future Security, 16).

The Defense Management Review produced several recommendations that have affected the way government depots operate. A system has been implemented through which maintenance and overhaul jobs are competed among the various DoD activities. Funding for operation of the bases and stations has been reduced to the point where only the activities which compete effectively will have a competitive cost structure for future work.

Additionally, large portions of the individual Service depot systems have been assumed by the Defense Logistics Agency. The DoD is also preparing a Joint Depot Consolidation Plan that will focus on the more effective management of the entire depot system.

Basically, the maintenance and repair sector of the DTIB shares many of the problems associated with the manufacturing sector. Reductions, consolidations, and streamlining activities will produce a more efficient maintenance infrastructure. This more efficient sector will be able to adequately satisfy the need of our armed forces during peacetime, but will have to be reconstituted to meet wartime requirements.

Integrated Management. Many management initiatives have

been taken in the recent past directed at DTIB preservation. During the last several years there has been a concerted effort within the Department of Defense to combine and consolidate its Research and Development activities. The thrust of such action is to eliminate duplication and redundancies in capabilities, resulting in a more efficiency at the macro level. Directed reductions in the size of operating staffs have helped to ensure that organizations take serious steps to make fundamental changes to improve the way they do business.

Another trend that falls within the realm of integrated management has been imposed through the implementation of the Defense Acquisition Workforce Improvement Act. The goal of this legislation is to improve the quality of DoD personnel engaged in systems-acquisition. The law requires that Components formally identify and classify members of their acquisition workforce into the categories of work they perform. At each level, there are mandatory training standards to help ensure individuals have the requisite knowledge base before progressing to a higher level in their career.

While many changes have been implemented to improve the management integration, there remain numerous opportunities for greater effectiveness in this area. Many provisions of the Defense Management Review (DMR), for example, have not been fully implemented. One of the primary conclusions of the DMR was that the efficiency of weapons systems acquisition could be markedly

improved if a higher degree of stability was instilled into the acquisition environment. Two recommendations that have not been effectively implemented are:

* Multi-year budget approval
* Greater use of multi-year contracts.

Programs and program budgets are subjected to annual analysis and adjustment at the congressional level. This practice continues despite the general consensus that it is wasteful and non-productive. The continued adjustment and redirection of programs artificially inserts cost and schedule risk into ongoing programs.

While multi-year contracting has authorized for some time, its use is extremely limited. Special authorization is required before a multi-year solicitation may be issued. The stability induced by long term contracts will cascade from the prime contractor to the subs and piece part suppliers. Once a commitment is made to produce a system, any technique to enhance the stability and efficiency of the procurement should be made.

While there have been many management initiatives that influence the DTIB, few have been integrated with efforts of other government agencies. The Defense Department will proceed in one direction while the Departments of Commerce and Energy will forge their own paths. The Congressional Office of Technology Assessment will produce recommendations in yet a different direction, while Congress enacts legislation that is

often driven by regional vice national considerations.

PRESCRIPTION FOR THE 1990's

There are many contributors to the development and maintenance of a healthy DTIB. It is important, however, to recognize that our national security needs are highly integrated with other national interests. For example, the economy of the nation must be sufficiently robust to support investments in national defense. Adequate health care provisions must be available to the citizens of the nation to enable vigorous pursuit of individual and national goals. There must be sufficient quantities of technically educated workers to compete in a global economy. There must be adequate transportation and telecommunications infrastructure in move raw materials, products, and information vital to the needs of industry, government, and individual citizens.

The organizations and activities that support this environment are continuously in competition for resources that are also required to maintain our national defense capabilities. So, at the macro level, a set of priorities must be developed which permit the allocation of scarce resources among the competing national interests.

In these times of reduced military threat, the focus of resource allocation has shifted more toward the *efficient* use of resources and away from their most *effective* use. The Defense

Industrial Base Strategy for the Twenty-First Century must recognize and accommodate this shift in emphasis.

Recommended actions to create a DTIB that is capable of satisfying the demands of Reconstitution are presented within the desired characteristics discussed in previous sections.

Advanced Research and Development Capability. The maintenance of our technological lead has received considerable attention from policy makers in the recent past. Of all the capability categories required to obtain and preserve a strong industrial base, advanced research and development is the most solidly pursued. The following actions should be instituted:

* Maintain level funding for RDT&E funding during the Future Year Defense Program
* Support pre-competitive research and development consortia similar to SEMATECH
* Enact permanent tax incentives for research and development
* Fully fund R&D efforts so that contractors are encouraged to adequately conduct the necessary tasks---without planning on recovering excess costs during production
* Support the engineering and manufacturing development phase with MANTECH funding when improvements in production processes are required---focus on sub-contractors and suppliers where much of the innovation transpires
* Fund technology development directed at cost reduction and dual-use
* Encourage the preservation of design teams and core competencies that are required to perform advanced research and development

* Combine and consolidate facilities to support advanced research and development---examine potential payoffs when selecting among new facilities candidates

* Closely coordinate publicly funded R&D among sponsoring federal agencies to ensure synergy

Technology Interchange Structure. In order to make the most efficient use of technology developments greater coordination/ cooperation among the government, industrial, and academic communities is necessary. Such interchange is not well conducted in the "American System." Much of the legislation and resulting policy is focused on fairness at the expense of efficiency. While we do well in insuring that there is equality in access to government work, and no unfair advantages are gained by current contractors in the pursuit of new work; we pay the price with inefficient interchange of technology and ideas. Technology interchange could be enhanced through the following actions:

* Continue the encouragement of Cooperative Research and Development Agreements

* Charter one federal agency with the responsibility of technology coordination with other government activities, as well as with industry and academia

* Provide regional technology extension offices to assist small businesses access to new technology

* Provide technology coordination through electronic data interchange

* Use performance specifications and allow commercial standards to the maximum extent practical in federal acquisition

* Develop federal accounting standards that encourage coordination commercial and government development efforts within shared facilities

* Explore methods that permit sharing of rights and data between the government and the developing contractor.

Innovative Acquisition Strategies. There is no shortage of new and innovative acquisition strategies that promise some assistance in improving either the efficiency or effectiveness of the industrial base. Many of these concepts have been demonstrated to be beneficial and should be continued. They include:

* Acquisition Streamlining
* Non-Developmental Item procurement
* Commercial Off-The-Shelf procurement
* Foreign Comparative Test program

Secretary of Defense Aspin, while serving as Chairman of the House Armed Services Committee, formulated a four point resource strategy that is as comprehensive as it is practical. The elements listed below were summarized in *Program Manager* (Cochrane, 39).

> *Selected Upgrading.* Maintain certain portions of the production base by upgrading existing systems. Conversion of M1 and M1A1 Abrams tanks to M1A2 configuration is an example.
>
> *Selective Low-Rate Procurements.* A system to keep selected critical suppliers in business through low-volume procurements, even if in excess of near-term needs: for example, naval nuclear reactor components.
>
> *Rollover Plus.* Expands on the 1990 concept of R&D rollover. The "plus" refers to added emphasis on manufacturing technology, operational testing, and concurrent engineering. Under this concept, before a system can be approved for production it must meet three criteria, 1) the technology works, 2) it is

required by the threat, 3) it represents a breakthrough that would alter the battlefield operations. If these criteria could not be met, then the technologies and the lessons-learned "rollover" into another iteration of development. The Army Block III Tank is a candidate.

Silver Bullet Procurements. Highly capable, technologically superior weapons, procured in limited quantities for selected operations. The F-117 stealth fighter is an example.

Efficient Engineering and Manufacturing Capability. Once the decision to proceed with a material acquisition has been made, it is the engineering and manufacturing capabilities of the industrial base that design and produce the desired equipment. Many problems faced during the engineering and manufacturing phase, however, find their roots in the requirements definition phase of the systems acquisition process. User Commands and their proponents have historically established requirements in a manner that optimizes system performance characteristics with little or no consideration of total system life-cycle cost. The result has been technically complex systems that are relatively expensive and take extremely long periods of time to field. Continuous dialogue with the Operational Community is required in order to ensure that the cost/performance trade-offs are fully understood.

Even when requirements are well formulated, and fully coordinated, the average time necessary to design and produce military equipment is unacceptably long. The technology employed in the design has often been superseded before the system is

fielded. In other words, the technology cycle is several times more rapid than our ability to design and fabricate a product. If we are to remedy this imbalance, greater emphasis must be placed on enhanced tools and techniques to make the manufacturing process more responsive. Two methods that continue to offer promise in this capacity are Computer-Aided Design/Computer-Aided Manufacturing, and Computer-Aided Software Engineering programs. Continued government support to the development of open systems architecture that supports integrated use of such tools should be continued.

Other steps that should be taken to provide a more efficient engineering and manufacturing capability include:

* Adequate funding of R&D phases in which the vast majority of decisions the effect the system life-cycle cost are made
* Help ensure program stability through the use of multi-year budgeting and multi-year contracting
* Fund to incorporate dual-use manufacturing techniques
* Fund for the incorporation of flexible manufacturing techniques
* Remove the barriers, previously discussed, that encourage the separation of government and commercial design and production facilities

Responsive Production Capabilities. In the recent past, the responsiveness of the production base was a direct result of over capacity within the defense industries. With reduced defense budgets, much of the defense production capacity will be sold or converted for commercial use. In efforts to deliver products at

the lowest cost, components and sub-systems will inevitably be produced off-shore. Maintaining a production capability that is responsive to defense needs is a major challenge.

The resource strategy proposed by Secretary Aspin attempts to do this by keeping defense contractors working, but at a slower rate. Some contractors would be engaged in upgrades, or selective low-rate procurements, while others would be employed in advanced technology, or "silver bullet" projects.

Dual-use and flexible manufacturing have been widely acclaimed as offering the solution to future production responsiveness. While these methods are sound in theory, they have yet to stand the test of wide spread implementation. If we are to rely on dual-use and flexible manufacturing, investments must be made to develop the processes and facilities that will respond to defense production needs.

One way to ensure that these capabilities are developed is to include such requirements in future contracts. Proposals could be evaluated on the offerers plan to incorporate dual-use technology, or employ flexible manufacturing processes. To minimize contractor risk, consideration should also be given to construction of government owned, contractor operated facilities until the principles are well accepted.

Some degree of foreign dependency in weapons systems components is unavoidable. It is important, however, that we

remain aware of potential bottlenecks to responsive production and take steps necessary to reduce their impact. One technique is to develop multiple sources to foreign made components, while another is to assure availability through bi-lateral or multi-lateral defense treaties with the nations involved.

Ability to Mobilize. We have a long way to go before we can consider ourselves adequately prepared for mobilization. It has been a half-century since this nation was forced to convert the means of production from commercial products to support our combat efforts during World War II. Auto manufacturers modified their lines to produce trucks and tanks. Building contractors converted their equipment and expertise to the fabrication of ships. While the quantities of war equipment that were produced by the "Arsenal of Democracy" are extremely impressive, it took "...about 3 years for the United States to reach its full capacity to produce airplanes and bombs, and 2 1/2 years to reach 25% of that" (Gansler, 264). Today the situation is no better.

> For example, a study of the ability to increase the production of the F-16 fighter plane found that-even with a plant that, at maximum production of the F-16 was only using one-third of its capacity-it would take over 3 years to increase output significantly. The reasons were (primarily) the inability to get critical parts and (secondly) a few production-line bottle-necks where a very expensive machine was already being fully used on three shifts and no additional machine was in the inventory (Gansler, 265).

Basically, we have not managed mobilization planning well. The Federal Emergency Management Agency (FEMA) is responsible for the coordination of mobilization efforts. In the coordination

role, FEMA has little authority in the way of financial resources or political clout. We should expect management of our mobilization efforts which includes providing the responsibility and authority and accountability for the development and implementation of a meaningful program.

Another management shortfall is the lack of information on which to make mobilization decisions. There is no single source of information that provides accurate data regarding long lead items or critical foreign sources. Accurate decision can not be made without access to data of this nature.

In order for the mobilization capability of an industry segment to be considered viable, it should be periodically exercised. Just as we would not consider sending troops to combat without training, we should not count on the ability of the DTIB to mobilize unless portions of it are exercised on a regular basis. While the Graduated Mobilization Response was officially adopted several years ago, little has been done to evaluate the suitability of this strategy in practice.

Until such actions are taken, the questionable ability to mobilize will be the weak link in the chain of Reconstitution.

Maintenance and Support Infrastructure. The maintenance and support structure is vital to the operational effectiveness and sustainability of our armed forces. Restructuring and downsizing that has pervaded the investment side of defense budgets is also

present in Operations and Maintenance. Depots and support activities are competing for the repair, rework, and maintenance tasks. With the reduced workload, some will eventually close. While the remaining facilities will be able to perform satisfactorily in peacetime, we must ensure that they retain the potential responsiveness needed during times of armed conflict.

Some efforts to maintain a viable support infrastructure, are outlined below:

* Fully integrate support requirements into the Mission Needs Determination and Operational Test activities
* Involve prime contractors in depot level maintenance. With primes involved, implementation of continuous product improvements will be more easily accomplished
* Encourage the rapid implementation of Computer-Aided Logistics Support (CALS) to ease the transition from development and manufacture to maintenance and support
* Ensure the training and education of support personnel is developed in proportion to the complex systems which they must maintain
* Encourage stability in the areas of maintenance and product improvement.

Ongoing assessments must be conducted to ensure the maintenance capabilities that we retain are sufficient to support forces in combat. The invaluable contribution of the support infrastructure during times of conflict must be spared from the peacetime budget cutters.

Integrated Management. In the past, it could argued that the government has provided too much management and too little

integration. When problems are perceived, all too often new laws or policies are generated with little regard as to the effect the new rules will have on those already in place.

Many of the recent initiatives, mentioned in previous sections, have merit and should be continued. Others need to be re-directed or refocused.

* The Defense Acquisition Workforce Improvement Act, for example, has initiated action in the proper direction to enhance the professionalism and capability of those within this environment. Additional improvements in this area could be realized from:
    * Allowing senior military acquisition professionals to remain on active duty, in lieu of retirement, as long as they are assigned to an acquisition billet.
    * Allowing greater flexibility for those entering appointed positions within the DoD. With current policies, an appointed official becomes virtually unemployable within the defense community at the completion of his appointment.
* Major improvements can also be made in the way the Department of Defense manages its procurement process. In the monopsonistic market place of weapons systems, the government is still learning how to be a responsible customer. Some practices worth adopting are listed below.
    * Use of standard commercial procurement practices when commercially available goods are being purchased. This would include most clothing food and materials purchases. In these cases, contracts would be awarded on the basis of best value judgement, with no right of protest.
    * Significant streamlining of the procurement could also be realized is the limits associated with Small Procurement were raised from the current maximum of $25K to $100K.
    * Encourage full use of "best value" contract award criteria, and institute procedures to make past performance an evaluation criteria for future contacts.

    - Encourage contractor "self certification" in lieu of employing a host of on-site government inspectors.

    - Explore methods that would permit the developers on new technology under government contract to have exclusive rights to the innovation...at least for a limited period of time.

* We must also adapt some of our decision making criteria to suit the new national security environment. Design to life-cycle cost should be used more frequently as our principal cost controlling mechanism. When performing cost and operational effectiveness analyses, a positive benefit should be assigned to methods, procedures or production rates that enhance our ability to mobilize or reconstitute.

* In attempting to manage or even monitor the status of the Defense Industrial Base, a more effective data analysis capability is required. The following capabilities are necessary.

    - Identify critical components of a weapon system, down to the sub-system and component level; as well as the number of potential suppliers

    - Identify the components and sub-systems that are obtained from foreign sources

    - Possess the capability to analyze an industry by sector

* Finally, help is needed for the Congress. Not help in the form of additional legislation, oversight, but a change in the nature of their involvement. Congress rightfully has the has responsibility to raise and supply our armed forces. The systems acquisition process could be performed more *efficiently*, however, if Congress would be more willing to set the broad policy, approving the overall direction of efforts rather than becoming routinely involved in the detail management of individual programs.

The government must learn to be a better customer and find ways to more fully cooperate and coordinate its actions with those of prospective suppliers and contractors.

CONCLUSION

During the past twelve years, even the mention of the term "industrial policy" seemed strictly forbidden in the halls of the Republican held White House. The basic premise was that the free market should be permitted to allocate resources among the various segments of the economy, including those that support the national defense.

Market forces provide the most efficient allocation of resources when allowed to operate unincumbered in a purely competitive market. The defense industry, however is monopsonistic in that there many suppliers, and only one consumer. Left alone, market forces alone may provide the most efficient allocation of resources, but they may not provide an industrial base that is responsive to our national security strategy. For example, would we be content with an industrial base that is no longer capable of producing nuclear submarines or one that takes three years to provide surge production of main battle tanks? We can allow the market make resource allocation decisions, but there is no guarantee that we will like the results.

The government has the responsibility to influence the market when the potential social benefit derived exceeds the inefficiencies experienced through such market intervention. Failure to establish policy in situations that warrant such action is a clear abrogation of this responsibility.

In these times of reduced federal expenditures on defense, the capability of our DTIB far exceeds the demand for its services. Industry is undergoing a period of rationalization to accommodate this disparity in supply and demand. To insure that these actions follow a course that is congruent with our national security strategy an Industrial Base Strategy is necessary to guide the speed and direction of change. The techniques and recommendations defined in the previous section should be incorporated into this strategy that will :

* Encourage the development of critical technology
* Provide sufficient design, production, and upgrade programs to satisfy peacetime needs and to maintain our design team and systems integration capabilities
* Maintain critical production facilities and expertise for potential future use.

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